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RESTORATION OF SOME EUROPEAN DINOSAURS, WITH SUGGESTIONS AS TO THEIR PLACE AMONG THE REPTILIA.

By O. C. Marsh.

WITH PLATES V–VIII.

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Restoration of Some European Dinosaurs, with Suggestions as to their Place among the Reptilia ;* by O. C. Marsh. (With Plates V–VIII.)

For several years, I have been engaged in investigating the Dinosaurs of North America, where these extinct reptiles were very abundant during the whole of Mesozoic time. The results of my study have been published from time to time, and I have already had the honor of presenting some of these to the British Association. In carrying out this investigation so as to include the whole group of Dinosaurs, wherever found, and bringing all under one system of classification, it has been necessary for me to study the remains discovered in Europe, and I have made several visits to this country for that purpose.

In comparing the forms known from the two continents, certain important differences as well as some marked resemblances between the two have been observed, and placed on record. In concluding my investigations of the North American forms, I have fortunately been able to make restorations of the skeletons of quite a number of very complete type specimens, and this has proved a most instructive means of comparing those from different horizons, and of different groups, among the known *Dinosauria* of America.

The success of this plan rendered it very desirable to extend it, if possible, to the best-known forms of European Dinosaurs. This I have been enabled to do in a few instances, and the main object of the present paper is to lay these latest results before you.

In approaching the subject of European Dinosaurs, and especially those of England, where the study of the group first began, I am well aware that I am on delicate ground, since many and various opinions have been expressed in regard to the nature of the remains here discovered, and particularly as to the form and appearance during life of the animals they represent. I may, perhaps, be permitted, in this connection, to say, what has often occurred to me, that the Dinosaurs seem to have been rather unfortunate, and to have suffered much from both their enemies and their friends. Many of them were destroyed and dismembered long ago by their natural enemies, but, more recently, their friends have done them further injustice in putting together their scattered remains, and restoring them to supposed life-like forms.

* Abstract of Paper read before Section C, British Association for the Advancement of Science, Ipswich, September 14, 1895.

You are all doubtless familiar with the story told by your witty countryman, George Lewes, in his life of Gœthe, of an international attempt to reconstruct the camel. To complete this task, the Englishman, it is said, travelled to distant lands, studied the animal in its native wilds, and then prepared his report; the Frenchman went to the museum in Paris, examined stuffed specimens and skeletons, and wrote his account; while the German remained in his study at home, meditated on the subject, and finally evolved his idea of the camel from his inner consciousness. Similar methods, but not on the same international lines, have been followed in the case of the Dinosaurs, and if some of those that have been restored could speak, whatever they might say about the prehistoric enemies that destroyed them, they would surely ask to be saved from their latter-day friends.

Seriously, I think justice has not been done to this remarkable group of reptiles in rehabilitating them for the benefit of the rising generation in science, and some of the attempts, I fear, have been so firmly implanted in text-book literature, that, like the oft-repeated myth of the "coral insect," the errors will pass down to the next century before being eradicated. The German method has sometimes been used by Anglo-Saxons, and with a success quite equal to that in the case of the camel. To take one instance familiar to you all, let me mention *Megalosaurus*, the first Dinosaur described, and also *Iguanodon*, an herbivorous colleague, on which it doubtless preyed. The first restoration of these two reptiles made them, as they were supposed to be in life, quadrupedal, or four-footed animals of forbidding aspect, and as such they have since haunted the visions of several generations, young and old, by night and by day. I have just made a pilgrimage to Sydenham to see with my own eyes these famous restorations, and, so far as I can judge, there is nothing like unto them in the heavens, or on the earth, or in the waters under the earth. We now know from good evidence that both *Megalosaurus* and *Iguanodon* were bipedal, and to represent them as creeping, except in their extreme youth, would be almost as incongruous as to do this by the genus *Homo*.

Lest it be supposed that I consider the Dinosaurs alone to have suffered from the attempts of their friends to restore them to life, I might recall to your remembrance the well-known figure in the text-books, of *Dinotherium*, reclining peacefully, with its feet and limbs concealed, for the simple reason that no one knew anything about them; or that other picture of the *Labyrinthodon* without a tail, deliberately making foot-prints upon the sands of time, while no such form has yet been discovered. I might refer to still more frightful examples of the dangers encountered by over-zealous historians of ancient life, but those given will suffice.

Restorations of European Dinosaurs.

The restorations of Dinosaurs I have now to present to this section are four in number, and represent some of the best-known European forms, types of the genera *Compsognathus*, *Scelidosaurus*, *Hypsilophodon*, and *Iguanodon*. These outline restorations have been prepared by me mainly for comparison with the corresponding American forms, but in part to insure, so far as the present opportunity will allow, a more comprehensive review of the whole group. The specimens restored are all of great interest in themselves, and of special importance when compared with their nearest American allies.

Compsognathus. (Plate V.)

The first restoration, that of *Compsognathus longipes*, Wagner, 1861, shown natural size in the diagram (Plate V), is believed to represent fairly well the general form and natural position, when alive, of this diminutive carnivorous Dinosaur, that lived during the Jurassic period. The basis for this restoration is (1) a careful study of the type specimen itself, made by me in Munich, in 1881; (2) an accurate cast of this specimen, sent to me by Prof. von Zittel; and (3) a careful drawing of the original made by Krapf, in 1887. The original description and figure of Wagner (Bavarian Academy of Sciences, 1861) and those of later authors have also been used for some of the details. No restoration of the skeleton of this unique Dinosaur has hitherto been attempted.*

Compsognathus has been studied by so many anatomists of repute since its discovery, that any attempt to restore the skeleton to a natural position will be scrutinized from various points of view. My interest in this unique specimen led me long ago to examine it with care, and I have since made a minute study of it, as related elsewhere, not merely to ascertain all I could about its anatomy, but also to learn, if possible, what its relations were to another diminutive form, *Hallopus*, from a lower horizon in America, which has been asserted to be a near ally. Both are carnivorous Dinosaurs, probably, but certainly on quite different lines of descent.

The only previous attempt to restore this remarkable Dinosaur was by Huxley, when in America, in 1876. He made a rapid sketch from the Wagner figure, and I had this enlarged for his New York lecture. This sketch, reproduced on the diagram before you (figure 1), represents the animal sitting down, a position which such Dinosaurs occasionally assumed, as shown by the footprints in the Connecticut Valley, which Huxley examined in place at several localities with great interest.

* The remains of the embryo within the skeleton of *Compsognathus*, first detected by me in 1881, while examining the type specimen, is not represented in the present restoration. This unique fossil affords the only known evidence that Dinosaurs were viviparous.

The great majority of Dinosaurian footprints preserved were evidently made during ordinary locomotion, although some series show evidence of more rapid movement. All those referred to carnivorous Dinosaurs are bipedal, and this is true of the footprints of many herbivorous forms.

FIGURE 1.—Sketch of *Compsognathus longipes*, Wagner. One-seventh natural size. (After Huxley.)

In the present restoration of *Compsognathus* (Plate V), I have tried to represent the animal as walking, in a characteristic lifelike position.

Scelidosaurus. (Plate VI.)

The second of these restorations is that of *Scelidosaurus Harrisonii*, of Owen, shown natural size in the diagram. This reptile was an herbivorous Dinosaur of moderate size, related to *Stegosaurus*, and was its predecessor from a lower geological horizon in England. This restoration is essentially based upon the original description and figures of Owen (Palæontographical Society, 1861). These have been supplemented by my own notes and sketches, made during examinations of the type specimen, now in the British Museum.

Scelidosaurus is a near relative, as it were, of one of our American forms, *Stegosaurus*, now represented by so many specimens that we know the skull, skeleton, and dermal armor, with much certainty. The English form known as *Omosaurus* is still more nearly allied to *Stegosaurus*, perhaps identical.

A restoration of the skeleton of *Scelidosaurus*, by Dr. Henry Woodward, will be found in the British Museum Guide to Geology and Palæontology, 1890, p. 19. The missing parts are restored from *Iguanodon*, and the animal is represented as bipedal, as in that genus.

In the present outline restoration of *Scelidosaurus*, I have endeavored merely to place on record my idea of the form and position of the skeleton, when the animal was alive, based on the remains I have myself examined. In case of doubt, as, for example, in regard to the front of the skull, which is wanting in the type specimen, I have used a dotted outline, based on the nearest allied form. Of the dermal armor, only the row of plates best known is indicated. The position chosen in this figure (Plate VI) is one that would be assumed by the animal in walking on all four feet, and this I believe to have been its natural mode of progression.

Hypsilophodon. (Plate VII.)

The third of these restorations, that of *Hypsilophodon Foxii*, Huxley, 1870, given in outline, natural size, in the diagram, has been made with much care, partly from the type specimen, and in part from other material mostly now in the British Museum. The figures and description by the late Dr. Hulke* were of special value, although my own conclusions as to the natural position of the animal when alive do not coincide with those of my honored friend, who did so much to make this genus of Dinosaurs, and others, known to Science. The restoration by Dr. Hulke is shown in another diagram.

In the case of *Hypsilophodon*, a number of specimens are available instead of only one. This makes the problem of restoration in itself a simpler matter than in *Scelidosaurus*. Moreover, we have in America a closely allied form, *Laosaurus*, of which several species are known. A study of the genus *Laosaurus*, and the restoration of one species given on the plate before you, will clear up several points long in doubt.

Huxley and Hulke both shed much light on this interesting genus, *Hypsilophodon*, indeed, on many of the *Dinosauria*. The mystery of the Dinosaurian pelvis, which baffled Cuvier, Mantell, and Owen, was mainly solved by them, the ilium and ischium by Huxley, and the pubis by Hulke. The more perfect American specimens have demonstrated the correctness of nearly all their conclusions.

Iguanodon. (Plate VIII.)

The fourth restoration here given, that of *Iguanodon Bernissartensis*, Boulenger, 1881, one-fifth natural size, has been made in outline for comparison with American forms. It is based mainly on photographs of the well-known Belgian specimens, the originals of which I have studied with considerable care during several visits to Brussels. The descriptions and figures of Dollo† have also been used in the preparation of this restoration. A few changes only have been introduced in the accompanying plate, based mainly upon a study of the original specimens.

* Philosophical Transactions, 1882. † Bulletin Royal Museum of Belgium, 1882–'88.

Besides the four genera here represented, no other European Dinosaurs at present known are sufficiently well preserved to admit of accurate restorations of the skeleton. This is true, moreover, of the Dinosaurian remains from other parts of the world outside of North America.

To present a comprehensive view of the Dinosaurs, so far as now known, I have prepared the plate here shown, which gives restorations of the twelve best-known types, as I have thus far been able to reconstruct them.* Of these twelve forms, eight are from America: *Anchisaurus*, a small carnivorous type from the Trias; *Brontosaurus*, *Camptosaurus*, *Laosaurus*, and *Stegosaurus*, all herbivorous, and the carnivorous *Ceratosaurus*, from the Jurassic; with *Claosaurus* and *Triceratops*, herbivores from the Cretaceous. These American forms, with the four from Europe already shown to you, complete the series represented on this chart. They form an instructive group of the remarkable Reptiles known as *Dinosauria*.

The geological positions of *Compsognathus* and of *Scelidosaurus* are fully determined, but that of *Hypsilophodon* and *Iguanodon* is not so clear. The latter are found in the so-called Wealden, but just what the Wealden is I have not been able to determine from the authorities I have consulted. The Cretaceous age of these deposits appears to be taken for granted here, but the evidence as it now stands seems to me to point rather to the upper Jurassic as their true position. If I should find the vertebrate fossils now known from your Wealden in the Rocky Mountains, where I have collected many corresponding forms, I should certainly call them Jurassic, and have good reason for so doing. Moreover, after visiting typical Wealden localities here and on the continent, I can still see no reason for doing otherwise so far as the vertebrate fossils are concerned, and in such fresh-water deposits their evidence should be conclusive. I have already called attention to this question of the age of the Wealden, and do so again, as I believe it worthy of a careful reconsideration by English geologists.

EXPLANATION OF PLATES.

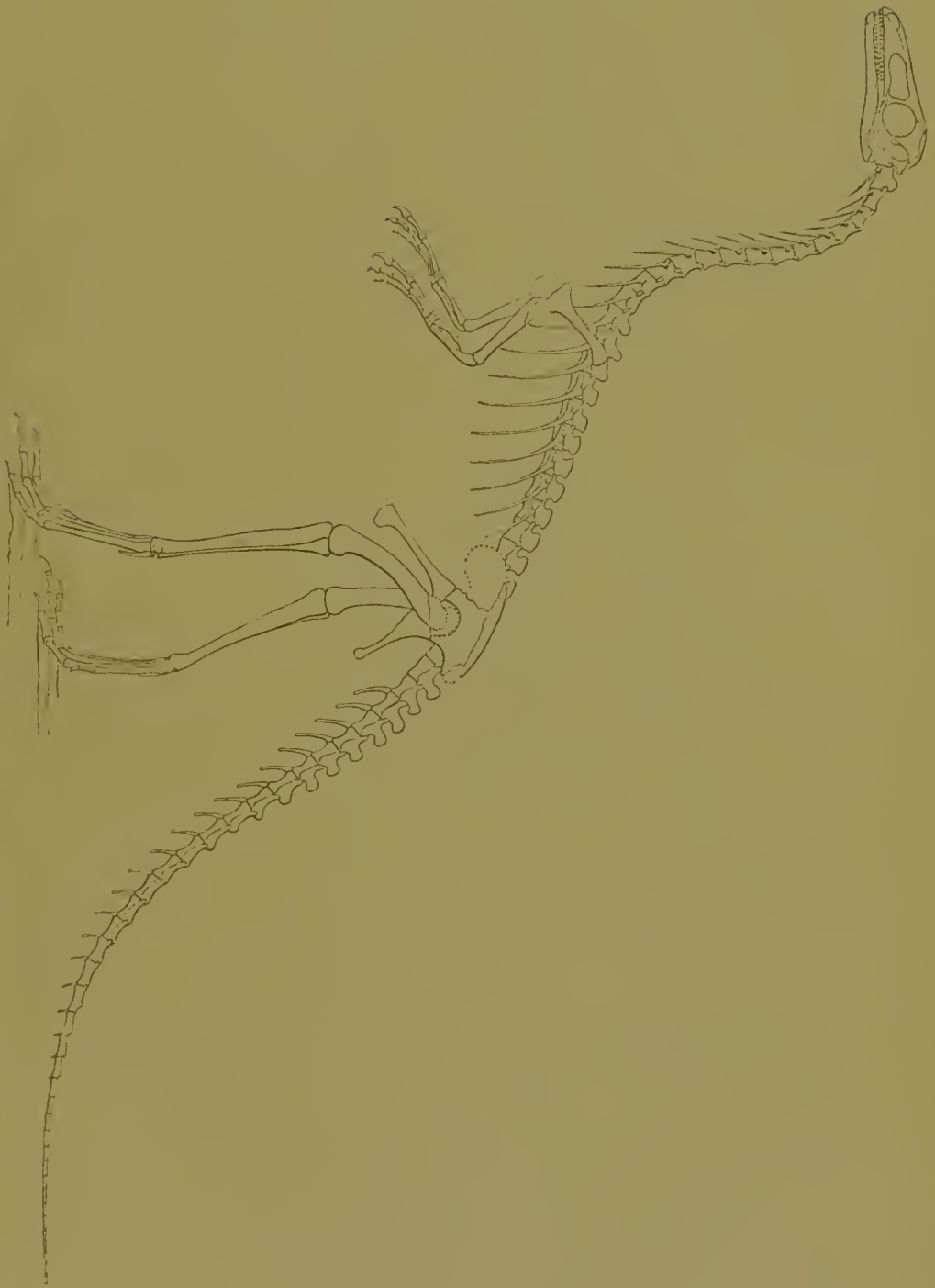
PLATE V.—Outline restoration of the skeleton of *Compsognathus longipes*, Wagner. One-fourth natural size. Jurassic, Bavaria.

PLATE VI.—Outline restoration of the skeleton of *Scelidosaurus Harrisonii*, Owen. One-eighteenth natural size. Jurassic, England.

PLATE VII.—Outline restoration of the skeleton of *Hypsilophodon Foxii*, Huxley. One-eighth natural size. Wealden, England.

PLATE VIII.—Outline restoration of the skeleton of *Iguanodon Bernissartensis*, Boulenger. One-fortieth natural size. Wealden, Belgium.

* A copy of this plate will appear in the next number of this Journal.



Restoration of Compsognathus longipes, Wagner. One-fourth natural size. Jurassic, Bavaria.

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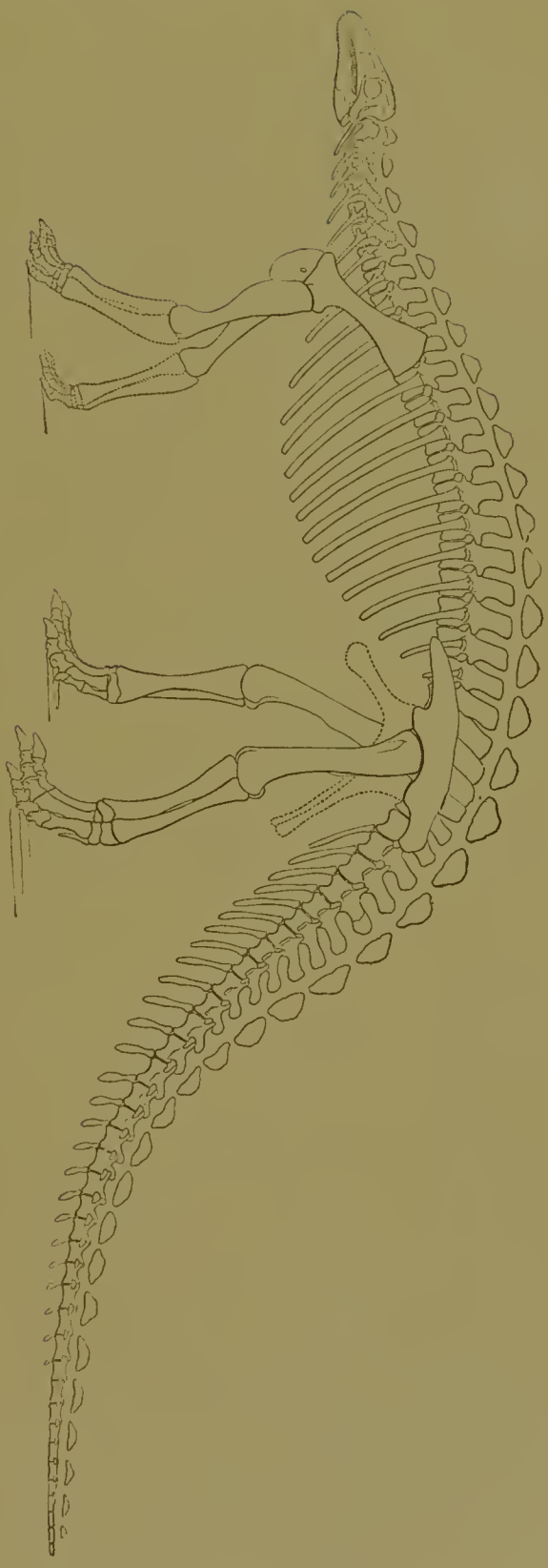
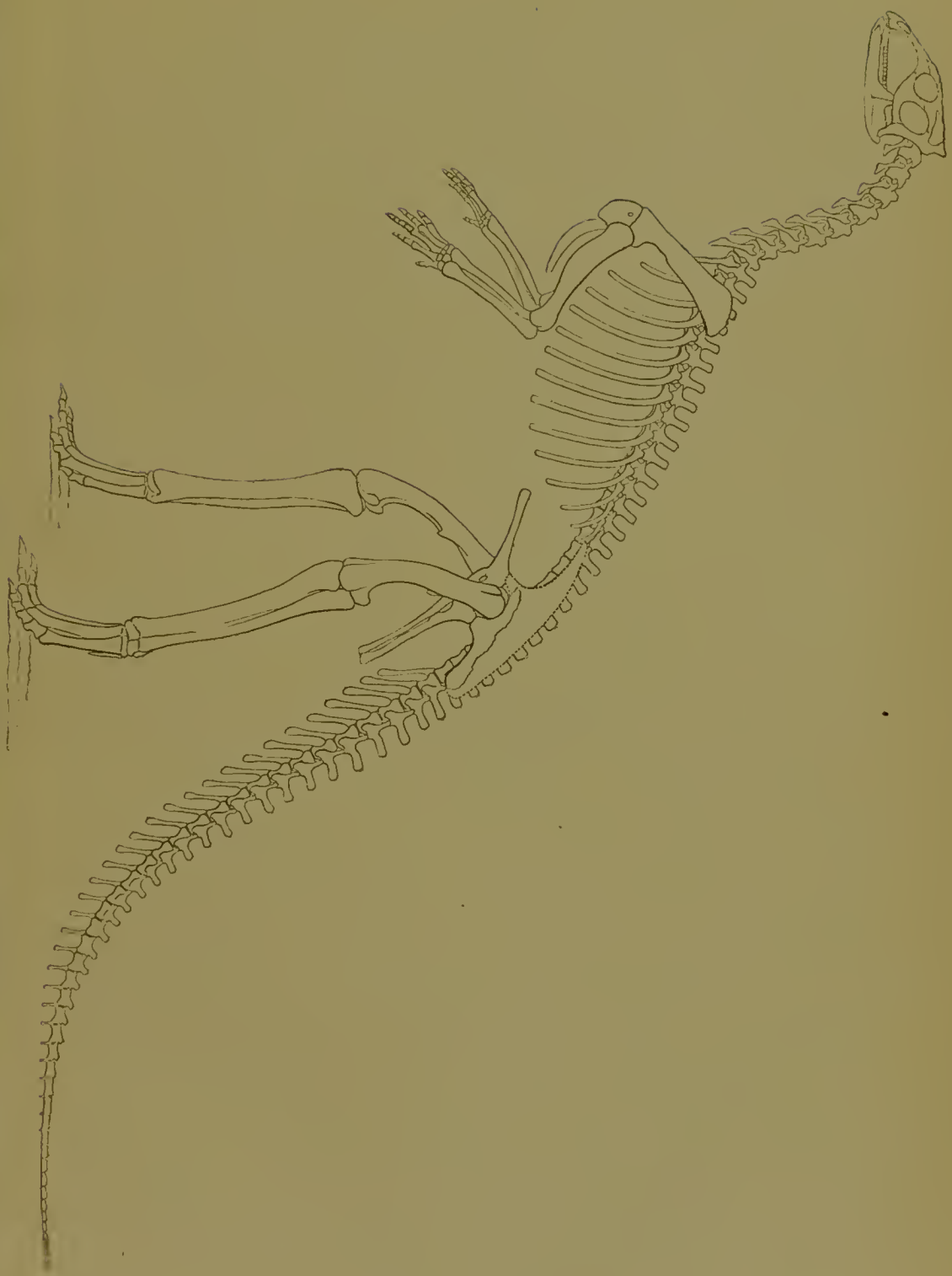


Restoration of SCELIDOSAURUS HARRISONII, Owen. One-eighteenth natural size. Jurassic, England.



Restoration of Hypsilophodon Foxii, Huxley. One-eighth natural size. Wealden, England.

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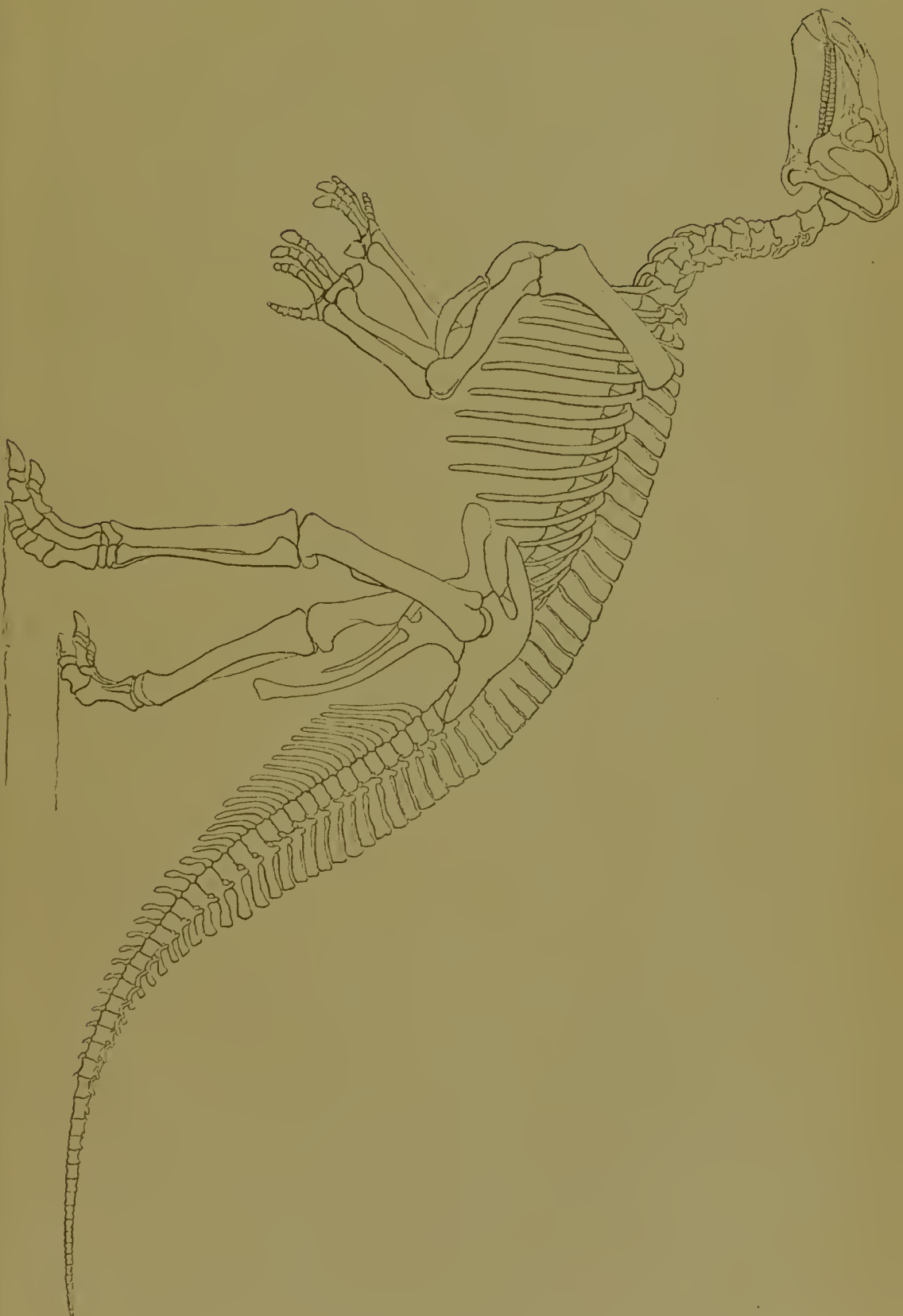

Restoration of IGUANODON BERNISSARTENSIS, Boulenger. One-fortieth natural size. Wealden, Belgium.

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